FAQ

802.11ac Wireless LAN FAQ

Frequently Asked Questions about 802.11ac Wireless LAN technology

General 802.11ac Questions

What is 802.11ac?

802.11 is a set of Wireless Local Area Network (WLAN) standards maintained by the Institute of Electrical and Electronics Engineers (IEEE). The original 802.11 standard was released in 1997 and enabled data rates of only 2 Mbps in the 2.4 GHz Radio Frequency (RF) spectrum. Since that time, several amendments have been made to the 802.11 standard, introducing more advanced technology features to ultimately enable higher throughput and increased range for wireless LAN clients.

802.11n was ratified in 2009 and is the latest ratified standard from the IEEE. 802.11n theoretically enables a client association rate of up to 600 Mbps per Access Point (AP) radio, with the current generation of APs supporting a client association rate of up to 450 Mbps per radio in both the 2.4 GHz and 5 GHz spectrums.

802.11ac extends on the 802.11n technology and enables client association rates of over 1Gpbs per radio in the 5 GHz spectrum only.

Is 802.11ac a ratified standard now?

Yes. Development of the 802.11ac standard commenced in 2008 and was ratified in December 2013.

How fast is 802.11ac?

The 802.11ac standard can theoretically support close to 7 Gbps of aggregate throughput per AP. As is the case with 802.11n however, the actual throughput achieved with 802.11ac varies based on many factors, such as capabilities of the client and AP, as well as distance from the AP and signal strength. The maximum association rate of the first phase of 802.11ac devices is around 1.3 Gbps per radio, with up to 600 Mbps of total throughput for clients.

How can 802.11ac achieve such high speeds?

802.11ac introduces a number of technical advancements including, but not limited to:

- Wider RF channels (including channel binding)
  - 80 MHz channels and 160 MHz channels in 802.11ac, vs. 40 MHz maximum in 802.11n.
- Increased number of spatial streams
  - 802.11ac supports up to 8 spatial streams, vs. 4 spatial streams in 802.11n. Most 802.11ac APs will typically support 3 spatial streams however.
- Denser modulation
  - 802.11ac supports up to 256-QAM encoding, versus 64-QAM in 802.11n.

The denser modulation in 802.11ac is where much of the performance benefit is achieved. For example, clients connected within close proximity to an 802.11ac AP that is configured to use 40 MHz channels and 3 spatial streams, can achieve an association rate of 600 Mbps. This is the same channel and stream configuration typically used in current 802.11n deployment, but with a 25% throughput increase. Increasing the channel width on an 802.11ac AP to 80 MHz will enable an association rate close to 1.3 Gbps, almost a 300% performance increase over 802.11n.

Why does 802.11ac work at 5 GHz only?

The primary reason that 802.11ac only works in the 5 GHz band is that only this band have the available RF spectrum to support the extended channel width. Available RF spectrum varies based on the regulatory domain; however in the US for example, the 2.4 GHz RF spectrum only allows 3 non-overlapping 20 MHz channels. This is not enough to support the 80 MHz channel width required for 802.11ac; therefore the 5 GHz spectrum must be used. The 5 GHz spectrum in the US allows for 21 non-overlapping 20 MHz channels, or 4 non-overlapping 80 MHz 801.11ac channels.

Do 802.11ac products require special certification or regulatory compliance?

No. As long as your regulatory region allows RF in the 5 GHz band, there are no additional certifications needed for 802.11ac. Fortinet APs do operate in 5 GHz in regions where this is allowed.

What is the difference between 802.11ac and 802.11ad?

801.11ad is another multi-gigabit wireless communication standard, however 802.11ad operates in the 60 GHz unlicensed RF spectrum instead of 2.4 GHz or 5 GHz. Radios operating at 60 GHz have a shorter range than 2.4 GHz or 5 GHz radios. As such, 802.11ad will be used in scenarios that require high throughput over a very short distance, such as a wireless replacement for HDMI or USB cables, rather than wireless LAN scenarios.

Do I need to buy new APs to support 802.11ac?

Yes. 802.11ac requires a new physical radio design, which means that new hardware is required. It is not physically possible to upgrade existing 802.11n radios to support the new 802.11ac standard.

Are there clients that support 802.11ac?

At this time, a limited number of clients currently support 802.11ac based on early 802.11ac chipsets, including some smart phones and other mobile devices. It is expected that the number of clients supporting 802.11ac will increase over time, and could even reach as much as 1 billion by 2015.

Will 802.11a/b/g/n clients be compatible with 802.11ac APs?

Yes. 802.11ac technology is backward compatible with previous wireless LAN technologies.

Will my LAN be able to support 802.11ac?

802.11ac begins closing the gap between wired and wireless LAN throughput, and in some cases, 802.11ac may operate at a higher speed than legacy 100Mbit Fast Ethernet wired switch ports. Even early 802.11ac products are likely to support 3 spatial streams and 80 MHz channels, putting theoretical wireless LAN throughput at around 1.3 Gbps. Once the overhead associated with wireless networks are taken into consideration, the realistic real-world throughput will still clearly exceed the capacity of legacy 100Mbit Fast Ethernet switches, and will therefore require a Gigabit Ethernet switching infrastructure at a minimum.

For ease of installation, Power over Ethernet (PoE) switching is beneficial and should be considered if an Ethernet Switching refresh is required, however this is not a direct requirement of 802.11ac as Fortinet 802.11ac APs will also support PoE via power injector technology. Some AP models (such as the FAP-320C) will be powered by standard 15.4 W 802.3af PoE, however other high-power output APs may require the higher power 25.5 W 802.3at PoE+.

Which environments or use cases is 802.11ac best suited for?

802.11ac is best suited for environment where high bandwidth and/or high density are required.

Some examples include:

- High bandwidth applications
  - Large file transfers (imaging)
  - Video distribution
  - Gaming
- High density environments
  - Education
  - Hospitals
  - Public networks

Should I delay my wireless LAN refresh or installation project to wait for 802.11ac?
It is important to understand that 802.11ac is here and the technology should be considered as part of any new wireless LAN decision making process, however it will take a while for 802.11ac clients to become prevalent and for APs to support the full range of 802.11ac features. For example, multi-user MIMO is an important feature of 802.11ac; however this feature will not appear across the industry until sometime in 2014.

802.11n is now a mature standard and provides enough capacity for most environments and will be the most logical products to purchase for some time. A Fortinet wireless solution is future-proofed in that any FortiGate wireless controller supports 802.11ac APs, as well as legacy 802.11n APs, so legacy APs can simply be swapped out for new 802.11ac APs when they are needed.

Fortinet 802.11ac Technology Questions

Can I use Fortinet 802.11ac and 802.11n APs in the same wireless LAN?
Yes. As has been the case previously with 802.11b/g/n APs interoperating in the same wireless LAN as 802.11a/b/g/n FAPs (for example, using a Fortinet FAP-11C in the same network as FAP-221B), Fortinet 802.11ac access points interoperate in the same wireless LAN as older legacy FAPs.

Do both the radios in the dual radio FAPs support 802.11ac?
Not necessarily. Make sure you check the datasheet for exact radio specifications, but as an example, the FAP-320C has a radio design where radio 1 operates at 2.4GHz b/g/n and radio 2 operates at 5GHz a/n/ac.

With the FAP-320C, can the two Ethernet ports be configured as an LACP trunk?
No. The two Ethernet ports on the FAP-320C operate in a redundant "failover" configuration and do not support LACP at the time of writing.

When using the dual radio FAPs, won't both radios provide more wireless bandwidth than the 1Gbps Ethernet port can handle?
No. Let's use the FAP-320C (Fortinet's highest throughput 802.11ac AP at time of writing) as an example. The FAP-320C supports a maximum client association rate of 1.3Gbps on the 5GHz 802.11ac radio and a maximum client association rate 450mbps on 2.4Ghz radio, for a total of 1.75Gbps. While this seems like it would saturate the 1Gbps Ethernet port on the FAP, the maximum client association rate is not equal to the real-world wireless LAN throughput. In reality, environmental conditions, client performance and other factors mean that the real-world wireless LAN throughput is typically less than two-thirds of the maximum client association rate. As such, a 1Gbps Ethernet port will not be a bottleneck when using a dual-radio 802.11ac FAP.

Are there any bandwidth limitations when using the 802.11ac APs with any of the smaller FortiGate models?
When 802.11ac FAPs are configured in tunnel mode (ie. all of the wireless LAN traffic passes through the FortiGate), the overall bandwidth utilization of the wireless LAN could potentially overwhelm the processing capacity of smaller FortiGate devices. It is important that the expected wireless LAN bandwidth utilization is taken into consideration when planning a Fortinet wireless LAN, to ensure the right size FortiGate wireless controller is implemented.

When the FAPs are configured with SSIDs operating in Local Bridge Mode, "local" traffic is bridged directly from the FAP to the wired LAN, without having to traverse the tunnel and be processed by the FortiGate. In this mode, the processing capacity of the FortiGate does not impact the wireless LAN.

What version of FortiOS is required to support the new 802.11ac FAPs?
The new 802.11ac FAPs (the FAP-221C and FAP-320C) will require the FortiGate wireless controller to be running at least FortiOS 5.2.